Logistics Management Institute

Improving the Navy's Material Safety Data Sheet Management Process

NA204R1

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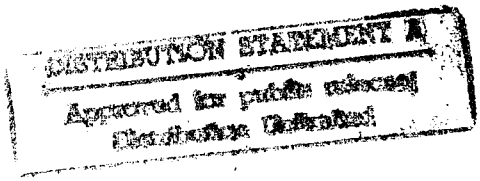

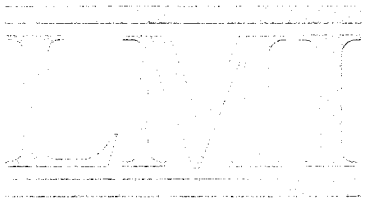

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The Occupational Health and Safety Administration (OSHA) Hazard Communication Standard requires employers to provide Material Safety Data Sheets (MSDSs) to their employees for all hazardous chemicals used at a work site. The DoD instruction 6050.5 defines this requirement for DoD services and agencies. While the current process currently meets the requirements mandated by regulation, it relies primarily upon paper and the U.S. Mail before ultimate distribution to DoD employees via the Hazardous Material Information System (HMIS). This reliance on paper results in a slow, labor-intensive process which delays the dissemination of vital safety information. In addition, the policy is currently enforced to require collection of an MSDS for every procurement action, even if the same record previously exists within HMIS. By clarifying policy to require collection of only original MSDSs and those developed by a manufacturer, the Navy could reduce processing volume by 70%. In addition, incorporating electronic data interchange (EDI) into the process would reduce the requirement for manual processes such as data entry, allow for parallel processing, and reduce the time required for quality control and eventual distribution. By clarifying policy and reengineering the business process to include EDI, we estimate the Navy could realize a savings potential of more than 50% of the current program cost. The technology for these improvements is available, but the Navy must carefully plan a migration strategy toward electronic processing which includes close coordination with industry trading partners.

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For their cooperation and genuine interest in improving Material Safety Data Sheet processing, we wish to thank the personnel we spoke with at the Defense General Supply Center, Navy Environmental Health Center, Ships Parts Control Center, U.S. Air Force, and General Services Administration.

Executive Summary

The Code of Federal Regulations requires manufacturers to write material safety data sheets (MSDSs) to inform purchasers of the hazardous characteristics of items they sell. The Navy developed a system that provided the MSDSs to its users in a timely manner for many years. However, our study indicates that this system can no longer efficiently handle the volume and complexity of data being received. The current process delays access to MSDSs for many hazardous material (HAZMAT) items until long after the HAZMAT has been received – posing a threat to safety. Time and resources are consumed by an outdated MSDS processing architecture. Duplicate submission transaction volumes exceed 70 percent of all MSDS submissions. Consequently, it is imperative to the safety of HAZMAT handlers and users that the Navy use existing technological innovations and process reengineering to improve system processing quality, utility, and efficiency.

An outdated processing architecture is the primary contributing factor to the delayed access to MSDSs. MSDSs are processed by three geographically dispersed Navy activities. The processing procedures are labor-intensive and time-consuming. An 8-month backlog of MSDSs needing review exists. Average processing time is 4 weeks. Without the aid of an electronic linkage, activities communicate inefficiently – exchanging MSDSs through the U.S. mail on paper or on diskettes.

The MSDSs, primarily in written form, are diversely formatted, reflecting individual companies' business and manufacturing practices, needs, and information systems. As a result, the Navy must manually rekey the information for each MSDS processed.

Excessive numbers of MSDS submissions, consisting primarily of duplicate MSDSs, exist because procurement activities are unable to easily determine if the same MSDS has already been submitted. Every distinct HAZMAT procurement action requires the submission of a new MSDS. Significant resources are expended by central MSDS processing points to identify duplicate MSDSs to preclude their input to the MSDS data base.

Using an electronic processing architecture that exploits existing telecommunications capabilities in conjunction with the use of electronic data interchange (EDI) technologies can initially reduce MSDS processing backlogs, improve data accuracy, and streamline document processing. Once data are more readily

available to potential HAZMAT handlers and users, either on-line or through more timely mass distribution methodologies, better-informed decisions can be made.

Navy policies exceed regulatory guidance by linking every hazardous item to a specific MSDS and establishing legal liability for product safety and handling with the manufacturer or distributor identified on the product. Consequently, multiple versions of the same MSDS are maintained in the MSDS data base. This subtle distinction in policy interpretation diverts the focus of the intended process from protection of employees and the environment to excessive volumes of data manipulation. We conclude that only manufacturers' MSDSs should be submitted to enable better conformance with the Code of Federal Regulations and reduce MSDS processing requirements.

The Navy's material management system does not fully accommodate HAZMAT-unique handling and storage requirements. Ongoing Navy initiatives address improved HAZMAT management, but they are neither tied to the material management system nor integrated among themselves. As a result, multiple processes and attendant resources are employed to collect, manage, and distribute many of the same or similar HAZMAT management data. We conclude that the strategic planning for and coordination of HAZMAT management initiatives, information system improvements, and the electronic exchange of HAZMAT data will dramatically improve system efficiency.

We recommend that the Navy adopt and execute an aggressive approach to HAZMAT data management by implementing the following actions:

- Establish an evolutionary electronic architecture for collecting, managing, and distributing MSDSs.

- Develop and sponsor policy changes requiring the one-time submission of an MSDS, the submission of only the manufacturer's MSDS, and the cross reference between products sold by distributors and the manufacturer's MSDS.

- Develop a continuing working relationship with industry to use a universally acceptable format (e.g., electronic data interchange) for codifying and electronically submitting MSDSs.

- Develop a strategic plan integrating Navy HAZMAT and electronic commerce initiatives. Use the MSDS data set to drive the processing and dissemination of information to other systems based on the original electronic receipt.

- We further recommend that, consistent with DoD objectives and corporate information management principles, the Navy coordinate its programmatic initiatives with OSD, other Services, and other agencies to ensure a consistency of business practices and standard approaches to information exchanges.

If the Navy takes these actions, we believe industry will be more cooperative in pursuing a progressive relationship with government to improve the electronic exchange and usefulness of HAZMAT information. The Navy is well-positioned to exploit current technologies and business process improvement opportunities in managing HAZMAT data requirements. Strong management support for an enhanced HAZMAT management system exists. The Navy already operates an aggressive electronic commerce program using EDI to exchange routine business information among its many commercial trading partners.

Cost-effective process reengineering of existing business practices will reduce procurement office workload, streamline data flows, eliminate the processing of duplicative MSDSs, and reduce the technical screening workload. By using EDI techniques to exchange MSDS information among its trading partners, the Navy will reduce paper handling delays and costs, improve data accuracy, and facilitate effective use of the MSDS data. We estimate that with these enhancements, the Navy could achieve an overall process cost reduction of approximately 57 percent.

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CHAPTER 1

Introduction

SCOPE OF THE PROBLEM

When improperly handled, hazardous material (HAZMAT)[1] used for operational purposes can pose a threat to employees and public safety. To minimize the risk associated with HAZMAT handling and use, the Navy developed the Navy Pollution Prevention (P2) Program. That program provides guidance for Navy managers in all phases of HAZMAT management – from acquisition and shelf-life programs to safe handling and disposal.

To handle HAZMAT safely, one must recognize the dangers inherent in its use. A cornerstone of the P2 program is the way in which HAZMAT characteristics are described and communicated to its handlers and users. The material safety data sheet (MSDS) is the document used to convey that descriptive information. The MSDS program was designed to provide data to users and handlers of HAZMAT to promote its safe handling, storage, use, transportation, and environmentally acceptable disposal.

Hundreds of thousands of MSDSs are currently in print. They address a wide variety of HAZMAT and reflect the business and manufacturing practices, the needs, and the information systems of many companies. Each year, procurements by the Navy require the addition of nearly 50,000 MSDSs, each requiring special attention. This individual attention is slow, expensive, and labor- and paper-intensive.

BASIS FOR HAZMAT COMMUNICATION AND REPORTING IN LAW

The Occupational Safety and Health Administration (OSHA) published administrative procedures in the Code of Federal Regulations (CFR), Title 29, Chapter XVII, section 1910, to address HAZMAT communication and operations in all segments of trade within CONUS.

Requirements for MSDS management in DoD are set forth in DoD Instruction (DoDI) 6050.5, *DoD Hazard Communication Program*. Generally, procedures specified therein are "judicially recognized," and thus, are legally binding on the various DoD Services and agencies.

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[1] For the purpose of this report, HAZMAT refers only to hazardous chemicals and not the waste resulting from their use.

Within the Navy, the Chief of Naval Operations (CNO) has designated the Naval Supply Systems Command (NAVSUPSYSCOM) as Executive Agent for overall P2 program management. The governing regulation is OPNAVINST 4110.2A, *Hazardous Material Control and Management.*

Industry Involvement in MSDS Design

Hazardous material management involves numerous complex environmental, social, and business issues. Evolving business trends emphasizing operating cost reductions and responsible environmental policy have fostered tremendous process improvement opportunities. Major chemical and related industry trade groups and associations have acknowledged the importance of comprehensive HAZMAT data and have developed a consensus position for a consistent MSDS written format and structure. This agreement marks the first step toward codifying a large portion of the MSDS data content, managing HAZMAT information in a relational data base, and using electronic commerce capabilities to exchange information among trading parties. Industry is increasing its activity in restructuring existing files and improving the automated management of HAZMAT information. We view this as an exciting opportunity for DoD because the public sector is completely dependent on industry to provide MSDS data.

Problems with Current MSDS Processing

The Navy's current method of managing MSDS data is slow and inefficient. These conditions exist, in part, because of policy and process weaknesses.

Seventy Percent of MSDSs are Duplicates

Policy weaknesses revolve around Navy guidelines that are more stringent than envisioned by the OSHA. Through 29 CFR, OSHA requires that handlers and users of HAZMAT have reasonable access to relevant safety data. As a result, manufacturers prepare an MSDS for each HAZMAT product they produce. Each distinct procurement requires submission of an MSDS. Since the same product is often procured many times, multiple MSDSs are collected for each product – causing duplication. The volume of duplicate MSDSs collected expands geometrically when one considers that many manufacturers use several distributors for each product, and each distributor's MSDS is treated as an original. The Navy collects approximately 50,000 MSDSs annually, adding excessively and unnecessarily to system workload because 70 percent are duplicates.

The MSDS Processing Architecture is Not Effectively Automated

The MSDS processing architecture is ill-equipped to handle the document volumes in a timely manner. Major participants in the MSDS process are geographically dispersed; they communicate through the U.S. mail. With paper and floppy disks as the primary media for data exchange, limited use of technology contributes to lengthy delays in data transfer, multiple instances of data entry, and frequent exposure to human keystroking and processing errors. The MSDS processing pipeline is approximately 4 weeks long, with a backlog queue of as long as 8 months. This delay sometimes results in HAZMAT use and disposal before the system has responded to the initial handler's and user's need for access to an MSDS.

SUMMARY OF RECOMMENDATIONS

Short Term

To eliminate immediate problems associated with the MSDS process and to fully comply with OSHA objectives, the Navy should implement policy and process changes that facilitate cost-effective operations within an electronic (i.e., automated) architecture. Immediate benefits will be forthcoming by eliminating the wasteful submission and processing of duplicate MSDSs. The Navy should sponsor policy changes to enable procurement activities to validate prior submissions of manufacturers' MSDSs and preclude subsequent resubmission of the same MSDS or a distributor's version of it.

Long Term

As a long-term initiative, the Navy should augment the objectives of its MSDS technical review process to streamline the data base through maximum use of a single MSDS for multiple products, in addition to ensuring accuracy. It should pursue that objective by supporting the maximum use of MSDS standardization through aggressive coordination with industry and the use of current data base management technology.

Lengthy MSDS processing time can practically be eliminated by using an electronic architecture. We recommend the following approach to implement that architecture:

- Aggressively coordinate with industry to establish electronic data interchange (EDI) trading arrangements.
- Employ commercial off-the-shelf software to automate MSDS receipt, distribution, manipulation, and management.

- Use the Navy's existing telecommunications network to electronically link all participants in the process.

Finally, from a strategic perspective, we recommend that the Navy develop a plan integrating the various scattered initiatives aimed at improving HAZMAT management. That plan should also address incorporation of HAZMAT management information requirements into the emerging material management system.

ORGANIZATION OF THE REPORT

This report documents the Navy's current MSDS handling process and our analysis of that process. We recommend ways to transition to a more efficient system by incorporating business process improvements and EDI techniques. Our recommendations constitute an evolutionary plan for electronically exchanging information with industry and coordinating the Navy-industry effort with the Federal government's standards for electronically exchanging data.

Chapter 2 describes the current MSDS process and discusses our findings and conclusions. Chapter 3 presents our recommendations for reengineering the HAZMAT management process. Appendix A documents the economic analysis performed. Appendix B provides a brief description of EDI. Appendix C is a glossary of acronyms.

CHAPTER 2

Current Process Flow of Material Safety Data Sheets

ORGANIZATIONAL RELATIONSHIPS

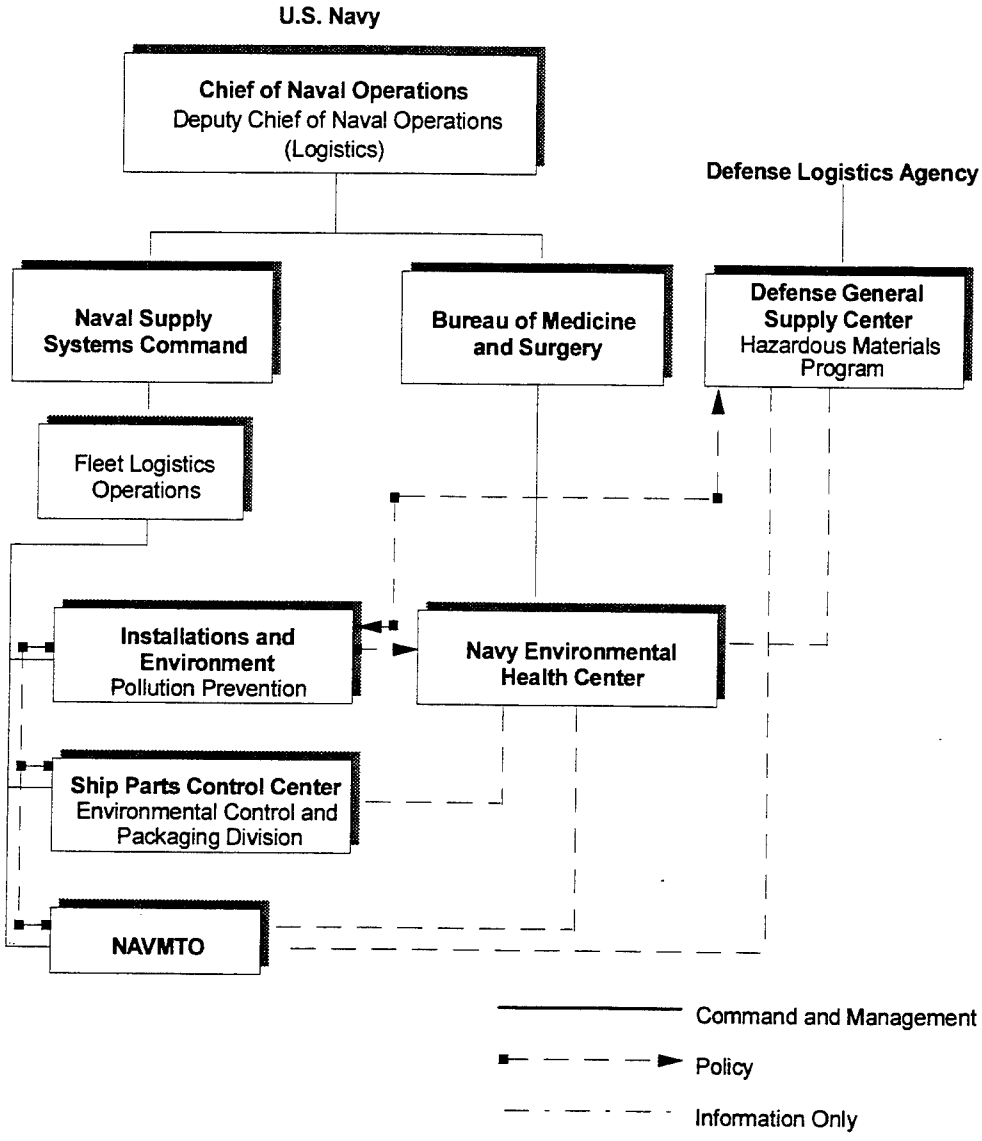
Figure 2-1 illustrates the relationships among the key participants in the material safety data sheet (MSDS) process flow.

The MSDS process flow involves an inter-Service-agency relationship between the Navy and the Defense Logistics Agency (DLA). Within the Navy, at the second echelon, the NAVSUPSYSCOM sponsors the Installations and Environment Pollution Prevention Office, and it has direct command authority over several organizations that act as subfocal points. The subfocal point organizations include the Navy Ships Parts Control Center (SPCC) and the Navy Material Transportation Office (NAVMTO), which are independent commands. The Pollution Prevention Office provides policy direction on MSDS processing for both organizations.

Also at the second organizational echelon and reporting directly to the Office of the Chief of Naval Operations is the Bureau of Medicine and Surgery (BUMED). It maintains command authority over the Navy Environmental Health Center (NEHC), which is the Navy's focal point for MSDS processing. While BUMED contributes to the overall pollution prevention program, it does not interact directly with any other participants in the MSDS process. The Pollution Prevention Office at NAVSUPSYSCOM provides NEHC with the financial resources and policy direction for MSDS processing. SPCC and NAVMTO are responsible for validating and providing specialized data requirements for MSDSs.

Within DLA, the HAZMAT program at the Defense General Supply Center (DGSC) operates the Hazardous Material Information System (HMIS), the central repository for all MSDSs provided to the Federal government. DGSC also is the focal point for all DLA-obtained MSDS processing actions.

The MSDS process incorporates a variety of functional relationships. For the overall process, because it is an inter-Service, interagency process, the highest common authority is within the Office of the Secretary of Defense. Within the Navy, the Deputy Chief of Naval Operations (Logistics) maintains both policy and management authority common to all participants.



Note: NAVMTO = Navy Material Transportation Office.

Figure 2-1.
Functional Relationships Among Key Participants in the MSDS Process Flow

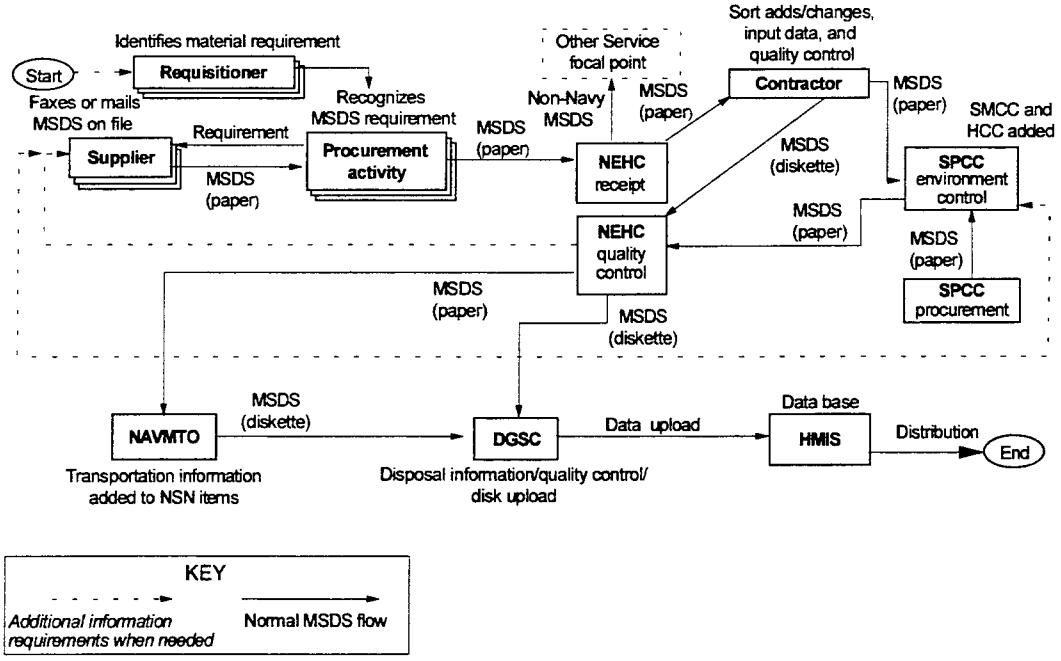
Because both the management and informational relationships are complex, extensive communication and policy coordination are required between DLA and each Service or agency, within the Navy, and among the separate contributing organizations. We do not find any evidence, however, to suggest that the organizational complexity adversely affects the quality of the MSDSs submitted to HMIS.

DESCRIPTION OF THE CURRENT MSDS PROCESS FLOW

Requirements for MSDS Submission

Title 29 of the Code of Federal Regulations requires that manufacturers of HAZMAT develop an MSDS for each hazardous item that they produce. Title 29 further requires that employers have an MSDS for each hazardous item they use. Department of Defense Instruction (DoDI) 6050.5, *DoD Hazard Communication Program,* prescribes the general flow of MSDS data from the manufacturer, the source of HAZMAT, to HMIS, the central point of MSDS distribution for the Federal government. Figure 2-2 depicts the information flow resulting from the Navy's implementation of DoDI 6050.5.

Chief of Naval Operations Instruction (OPNAVINST) 5100.23B, *Navy Occupational Safety and Health (NAVOSH) Program Manual,* requires the requisitioner to clearly indicate on the requisition that the item being ordered is hazardous. Federal Standard 313C, *Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities,* identifies the Federal Supply Classes of potential HAZMAT in two separate tables. An MSDS must be submitted for *all* HAZMAT items listed in Table I and for the items listed in Table II that have one or more of the hazardous characteristics identified in Federal Standard 313C.



Note: SMCC = Specific Material Content Code; HCC = Hazardous Characteristics Code; NSN = National Stock Number.

Figure 2-2.
Current MSDS Information Flow Resulting from the Navy's Implementation of DoDI 6050.5

One Navy goal is to minimize the proliferation and use of HAZMAT during all operations. To this end, the Navy publishes lists of authorized HAZMAT for use on ships and by shore activities. A ship's HAZMAT list (SHML) identifies hazardous items authorized for use by each Navy ship. An authorized use list (AUL) accomplishes the same purpose for shore activities. Requisitions for HAZMAT not identified on the appropriate authorization list must be accompanied by a written certification describing the requirement for that HAZMAT.

On ships that have a safety office (mostly supply and maintenance tenders that store HAZMAT for longer periods of time), the supply or maintenance office obtains an MSDS for review by a safety officer and approval from a Commanding Officer prior to requisitioning HAZMAT. They obtain the MSDS from HMIS-generated output if available, or from the manufacturer or vendor for material when HMIS does not have an MSDS on file. The MSDS is provided with the requisition to the procurement activity. Shore activities and ships without safety offices generally do not provide an MSDS with the requisition.

When acquiring HAZMAT, contracting officers for Navy procurement activities insert, in all contracts, clause 52.223-3, "Hazardous Material Identification and Material Safety Data," from the Federal Acquisition Regulation (FAR). This clause requires an offeror to list any HAZMAT to be delivered under the contract and to agree to submit an MSDS for each item as required prior to contract award. Unless the contracting officer has recently procured the same hazardous item, he or she will require that another MSDS be provided by the seemingly successful offeror as a prerequisite to contract award. The contracting officer typically telephones that offeror to request the MSDS.

Distributors or repackagers of HAZMAT usually obtain MSDSs from the product manufacturers. In some cases, a distributor assigns its own part number to material and develops a new MSDS. Upon request by the contracting officer, the manufacturer or distributor faxes or mails the desired MSDS in response.

MSDS Processing

Upon receipt of HAZMAT, contracting officers mail their copies of the MSDSs to the Navy Environmental Health Center (NEHC); the contract is awarded *without* feedback from NEHC about the accuracy or quality of the MSDS. The contracting officer maintains a hardcopy of the MSDS on file.

The NEHC is designated as the Navy's single focal point for obtaining, reviewing, augmenting, and providing MSDS information to HMIS. Upon receipt, NEHC assumes administrative control over MSDSs, and, on a weekly basis, provides hardcopy originals to a contractor responsible for several administrative, screening, and quality review functions. That contractor is responsible for the following operations:

- separating the MSDSs into those for the Navy and those for non-Navy-managed items;

- sorting MSDSs for Navy-managed items into duplicate MSDSs, new MSDSs, and updates or changes to existing MSDSs;
- researching the national stock number (NSN) and assigning local control numbers to those items for which an NSN does not exist;
- performing MSDS quality reviews; and
- entering the MSDS data onto computer files and floppy disks for forwarding, on a weekly basis, to NEHC along with the original MSDS, a copy, and a computer printout.

Once NEHC receives the MSDS data,

- for *non-Navy-managed items*, NEHC mails a copy of the MSDSs to the appropriate Service or agency focal point (and files the original) and
- for *Navy-managed* items, NEHC
  - compares the hardcopy MSDS against the computer printout provided by the contractor,
  - performs further quality review,
  - makes required corrections on the floppy disks,
  - mails the MSDS computer printout and a copy of each MSDS for Navy-managed NSN items to NAVMTO and SPCC,[1] and
  - mails a copy of any updated MSDS diskettes received from SPCC to DGSC to be loaded into HMIS.

FINDINGS AND CONCLUSIONS

MSDS Process Flow Deficiencies

The current process of evaluating and preparing an MSDS for loading into HMIS is time-consuming and labor-intensive. It typically takes approximately 4 weeks to complete the MSDS processing cycle. The three Navy activities involved in that processing, being geographically dispersed and lacking electronic

[1] As a Navy subfocal point, NAVMTO is responsible for the transportation section of MSDSs for Navy-managed NSN items. While a manufacturer's MSDS provides transportation data about a single mode of transportation, NAVMTO provides data for all other modes of transportation. NAVMTO provides diskettes containing that information directly to DGSC for loading into HMIS. As a Navy subfocal point, SPCC is responsible for adding the special material characteristic code (SMCC) and the hazardous characteristic code (HCC) to MSDSs for Navy-managed NSN items. SPCC also returns the updated diskettes directly to DGSC.

linkages, are forced to communicate inefficiently, receiving and sending MSDSs and value-added data through the regular U.S. mail system.

The focal point is responsible for converting an MSDS into an HMIS format and must manually key the data into records on a personal computer. Because MSDSs contain mostly textual, nonstandardized data, the data-entry process is inefficient, largely because of the failure to use time-saving data-entry techniques. For example, "macro" keys are rarely used to enter often repeated blocks of words.

The lack of MSDS data standardization is further complicated by HMIS construction and data field length limitations. Data exceeding HMIS field limitations is inconsistently abbreviated and often keyed into other available fields without consideration for the need to associate the data with the relevant field. Therefore, the MSDSs obtained from HMIS are often disjointed and not a true representation of the data provided on the original MSDS.

The NEHC has used a contractor since July 1991 to assist with processing a backlog that had grown to 41,000 MSDSs. Since then, the backlog declined steadily. As of 9 December 1993, NEHC retained a backlog of approximately 4,400 MSDSs (awaiting final quality review and submission to DGSC by NEHC) that had already been processed by NEHC's contractor since April 1993. Now, NEHC is working to eliminate that residual 8-month backlog as well as to keep pace with MSDSs generated through new procurements. The delay caused by the backlog and the normal processing time means that, in many cases, HAZMAT is received, handled, used – and in some cases disposed of – before the MSDS is available through HMIS. Handlers and users of HAZMAT are therefore solely dependent upon the MSDS paper form that should accompany shipments of HAZMAT. And if *that* MSDS is not available, significant time is expended in obtaining the MSDS from the manufacturer or an alternative source.

We conclude that significant opportunities exist to cost effectively reengineer the processes for collecting, managing, distributing, and processing MSDSs. The long delays and lost time associated with repeated handling and control, inefficient movement, and manual processing of MSDSs can be reduced significantly by using electronic processing.

For the most part, the architecture required to electronically receive and process MSDS data already exists. For example:

- Access to telecommunication networks and connections are in use and available to many.

- A combination of existing, regionally-based Navy electronic data interchange (EDI) MSDS processors, servers, and translation software, as well as connections with value-added networks (VANs), provide the capability to exchange MSDS data with commercial trading partners.

- Commercial off-the-shelf software is available for MSDS management and could be modified, if necessary, to manage the data in formats prescribed by DoD within an electronic environment.

- Industry is moving toward restructuring MSDS files into relational data base formats and is using EDI to transmit MSDSs.

Opportunities for exploiting the existing electronic architecture are embodied in our description of a reengineered MSDS process, which is described in Chapter 3.

Submission of MSDSs

To ensure that an MSDS is resident in HMIS for every hazardous item procured, the Navy's policy requires that all procurement activities submit an MSDS to the focal point for each procurement of HAZMAT. The focal point is responsible for receiving, sorting, and verifying whether the MSDS is already resident in HMIS. Navy procurement activities currently submit 800 to 1,000 MSDSs to NEHC each week, approximately 70 percent of which are already resident in HMIS. Those 70 percent are duplicates. We were informed that this strategy is followed because contracting officers at Navy procurement activities do not have easy access to HMIS to determine whether the MSDS is already in HMIS. Also, they do not have the technical skills required to evaluate the content of an MSDS.[2]

The two procurement activities that we interviewed do submit an MSDS to the focal point for every procurement of each item of HAZMAT. We were subsequently informed, however, that many procurement activities do *not* submit MSDSs at all. In order to comply with an Inspector General's (IG's) audit finding, some of those latter activities submit a great volume of MSDSs for past procurements, overwhelming the focal point's ability to process them. Except for IG audits, we were unable to identify a mechanism for ensuring that all procurement activities submit MSDSs. Consequently, a strong potential exists to completely overwhelm focal point processing capabilities if all procurement activities start submitting MSDSs routinely for all HAZMAT acquisitions.

We conferred with the action office responsible for DoDI 6050.5 to determine its intent with respect to when an MSDS should be submitted by a procurement activity. We were told that if a manufacturer's MSDS for particular HAZMAT is resident in HMIS, procurement activities need not obtain the MSDS upon subsequent procurement unless the manufacturer has modified it. The CFR is

[2]HMIS data are available on both microfiche and CD-ROM disks. Contracting officers at procurement activities prefer not to use microfiche; the CD-ROM reader is often not readily available. Additionally, the CD-ROM version of HMIS is issued quarterly and, because of processing timeframes, does not contain MSDSs sent to the focal point during the last processing quarter prior to publication. Additionally, the delay in loading MSDSs prevents visibility of those in process. Consequently, contracting officers thought it was easier to ask the contractor to provide an MSDS rather than determine if an MSDS was already resident in HMIS.

consistent with this guidance. The Federal Acquisition Regulation's (FAR's) clause 52.223-3, "Hazardous Material Identification and Material Safety Data," however, is currently interpreted as requiring that an MSDS be provided by a manufacturer for every procurement of HAZMAT.

We conclude that, notwithstanding the FAR clause, the duplicate submission and processing of MSDSs can be eliminated by the reengineered process described in Chapter 3. Specifically, duplicate MSDSs can be precluded if procurement activities have easy access to current and accurate HMIS data. Opportunities then exist for procurement activities, instead of the focal point, to determine the presence or absence of an MSDS in HMIS, and, if resident, preclude the unnecessary submission and processing of a duplicate MSDS. If the Navy is concerned with the literal compliance with the FAR, it should petition for a blanket deviation.

Program Objectives

We found that the general process is driven by a requirement to obtain (and load into HMIS) an extract of the MSDS for every hazardous item produced by each manufacturer and distributed by each vendor (if the product is distributed under the vendor's name).[3] The impetus for the requirement is to ensure that the product, bearing the hazardous chemical identification, the MSDS date, and the manufacturer, or the vendor if distributed under its name, can be linked through that information to an MSDS prepared specifically for that product. The linkage is necessary in order to match the MSDS to the product it was prepared for and thus establish legal liability for safety and handling of the product with the manufacturer or distributor identified on the product. That requirement applies even if the same item with the same hazardous qualities is produced by two or more manufacturers, or produced by a manufacturer and distributed without alteration by a vendor under its name.

The CFR requires manufacturers, not distributors, to develop or obtain an MSDS for each hazardous item produced. For complex mixtures that have similar hazards and contents (i.e., the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), it also permits the manufacturer or employer (in this case, the Navy) to prepare one MSDS to apply to all of the similar mixtures. HMIS, however, is not currently capable of relating multiple hazardous items to a single MSDS.

We conclude that the objective of the MSDS process unnecessarily exceeds the requirements set forth by the Occupational Safety and Health Administration in the Code of Federal Regulations (CFR). The link between a hazardous product and an MSDS is required by the CFR to ensure employee access to relevant material safety data.

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[3] HMIS records consist of fixed-length fields that may not accommodate the full text included on the MSDS. The fixed-length fields may require abbreviation of the MSDS information by the focal point. In some cases, the information from the MSDS is enhanced by the focal point or modified as a result of quality review prior to input to HMIS.

The relevancy of material safety data is only dependent on whether it accurately communicates information concerning the hazards associated with HAZMAT. If that information is accurately communicated by the manufacturer's MSDS, input of the distributor's MSDS yields no benefit in relation to the requirements of the CFR, provided the product bears the manufacturer's identity. Likewise, if an existing MSDS for one product accurately communicates information concerning the hazards associated with another product (regardless of the manufacturer), input of another MSDS that communicates the same information provides no benefit in relation to the requirements of the CFR, provided both products can be linked through HMIS to the relevant MSDS.

Because of the stringent implementation of the CFR, the MSDS process is not clearly focused upon the needs of HAZMAT handlers and users. The increased volume of MSDSs that must be processed and managed to accommodate the more stringent implementation also requires more resources.

Nonstandard Material Procurement

Only about 1 percent of all MSDSs received are for Navy-managed NSN items; about 10 percent are for non-Navy-managed NSN items. Therefore, approximately 89 percent of the 800 to 1,000 MSDSs that NEHC receives each week are for nonstandard HAZMAT. The fact that 70 percent of MSDSs received by NEHC are duplicates indicates that nonstandard HAZMAT is being procured repeatedly in low volumes and by numerous activities.

The effectiveness of the SHML and AUL to limit the proliferation of HAZMAT and the process for converting nonstandard material to cataloged material based on demand are questionable. With respect to the overall management of HAZMAT, we maintain that those issues are significant enough to warrant further analysis.

Hazardous Material Management

The Navy material management system does not accommodate the unique requirements associated with handling and storing HAZMAT. The Navy has undertaken several initiatives to improve HAZMAT management, but they are neither tied to the material management system nor integrated among themselves. Rather, each initiative is being developed independently to improve specific aspects of HAZMAT management.

We conclude that HAZMAT management initiatives and existing management information systems are not fully or strategically coordinated. As a result, the probability increases that multiple processes and resources are employed to collect, manage, and distribute many of the same or similar data.

CHAPTER 3

Reengineering the Process: Recommendations

In the previous chapter, we discussed the current paper-based methodology for processing MSDS data. In this chapter, we present our recommendations about how the insertion of policy changes, process reengineering, and advanced technology will improve the Navy's business practices and more efficiently use its limited resources.

The most dramatic improvements in MSDS processing will derive from efficiencies created by process improvements. Reducing and ultimately eliminating the submission of duplicate MSDSs, coupled with electronic-based MSDS submission and processing, afford the Navy significant workload reduction opportunities and increased system responsiveness.

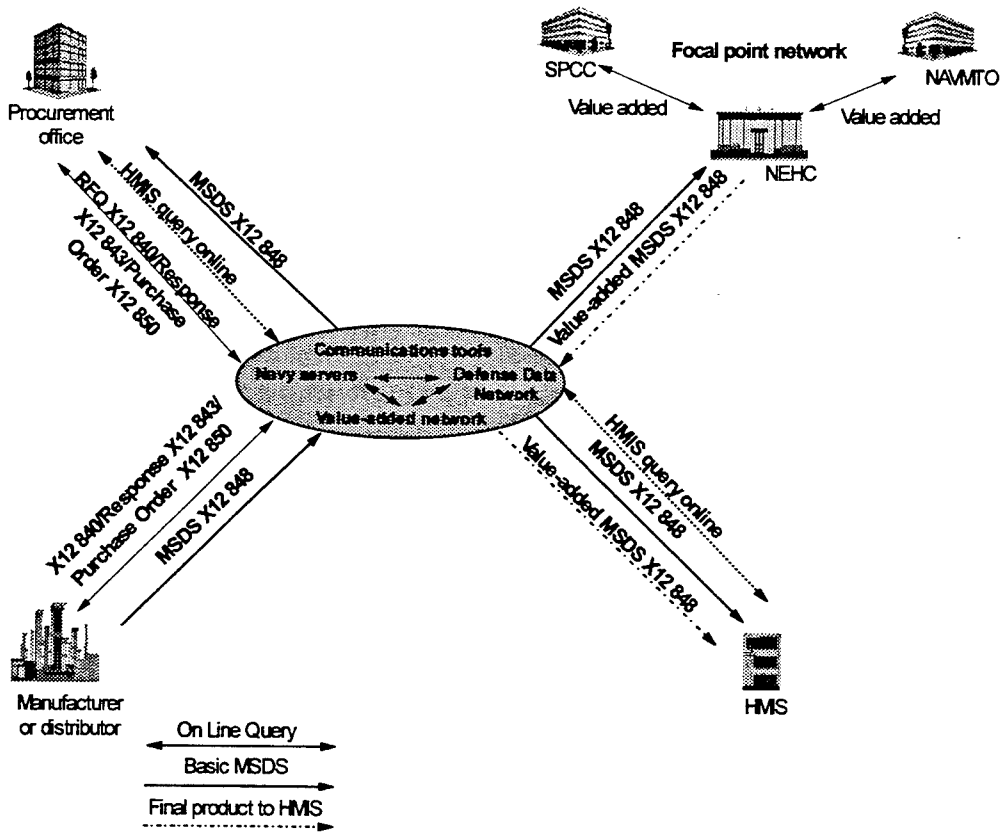
POLICY

Current policies must be changed to activate MSDS process improvements. Those changes must support the primary objective of punctually providing HAZMAT handlers and users a manufacturer's MSDS – not some peripheral objective such as establishing a contracting audit trail with the vendor. Accordingly, the Navy should sponsor the following policy changes:

- Announce the Navy's intention to exchange business data electronically.
- Encourage manufacturers and distributors to submit MSDSs electronically.
- Encourage manufacturers to use a single MSDS for multiple HAZMAT products when those products exhibit similar compositions and hazards.
- Provide procurement activities with "ready-access" to MSDS information.
- Require one-time submission of MSDSs and updates.
- Permit submission only of manufacturers' MSDSs (regardless of the distributor).

AN ELECTRONIC ARCHITECTURE FOR MSDS DATA FLOW PROCESS REENGINEERING

The current architecture (see Figure 2-2), characterized by total reliance on the exchange of paper products through the mail, results in unacceptable processing timeframes. Figure 3-1 illustrates an alternative approach to collecting and distributing MSDS data, using the capabilities provided by EDI and electronic networking. Figure 3-1 is a notional "macro" view of the MSDS process featuring the primary participants along with our addition of a VAN in combination with existing Navy servers, translation software, and data networks. The VAN and server provide the "mailbox" services necessary to simultaneously distribute the data to multiple participants.



Note: RFQ = request for quotation; HMIS = Hazardous Material Information System; MSDS = material safety data sheet; SPCC = Ships Parts Control Center; NAVMTO = Navy Material Transportation Office; NEHC = Navy Environmental Health Center.

Figure 3-1.
Proposed Electronic Collection and Distributing MSDSs

The characteristics of electronic processing differ from those of the current process in several ways. In the electronic-based environment, emphasis is placed on significantly reducing data replication, redundant processing effort, and the time required to make the MSDSs available to HAZMAT handlers and users. Specifically, our proposed approach includes the following processing enhancements:

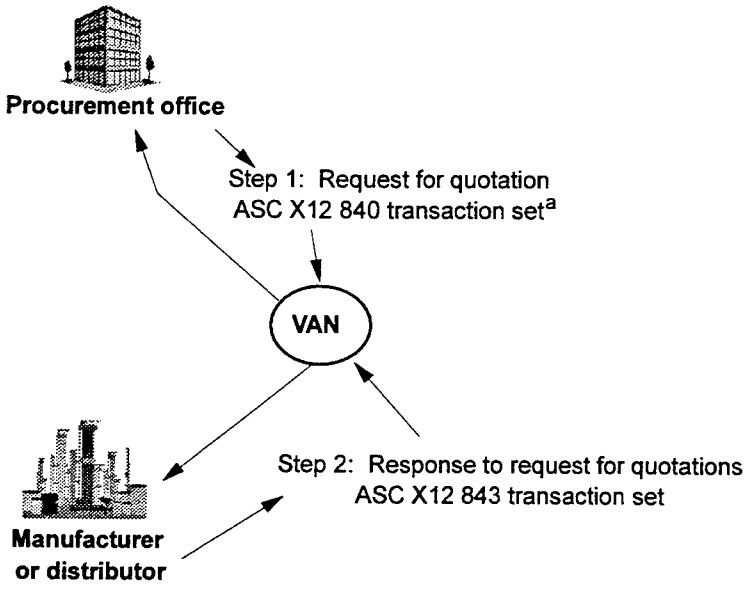
- Procurement offices will be able to verify the existence (or absence) of an MSDS record within HMIS at the time of contract award.
- One-time electronic submission of an MSDS and its updates will be required for each manufacturer's unique HAZMAT product formulation.
- Simultaneous transmission of MSDSs to focal points for review and to HMIS for expeditious input and initial dissemination to users will be possible.
- A "focal point network" will be used for adding value to records in a focal point data base from a remote location.

The illustrations in the subsections below explain the various notional process phases of the proposed electronic-based MSDS process in some detail.

Phase 1

The interaction between HAZMAT suppliers and procurement offices is the front end of MSDS processing. For any purchase, the elements of HAZMAT procurement include those processes identified in Figure 3-2. An electronic purchase takes place using those American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 EDI procurement transactions[1] already developed for, and used by DoD. The potential HAZMAT offeror responds with a certification referencing the specific MSDS reference number and revision information.

[1] See Appendix B for a discussion of ANSI ASC X12 EDI standards.

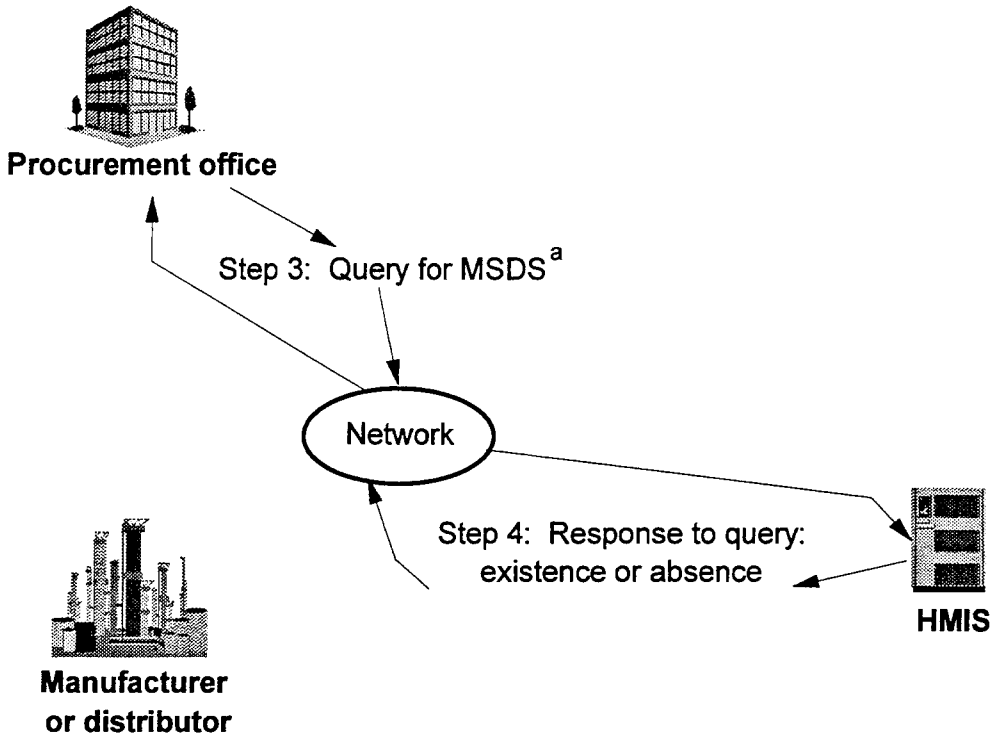


[a]During the initial procurement actions, the procurement office selects a supplier.

Figure 3-2.
HAZMAT Procurement Processes

Phase 2

For HAZMAT purchases made after selecting a supplier but prior to award, the procurement office would query HMIS data to confirm the existence of an MSDS on the basis of its serial number and revision number, the manufacturer's part number, the Commercial and Government Entity (CAGE) code, and the MSDS's effective date (see Figure 3-3). Upon confirmation that HMIS already has the specific record and that there have been no revisions, the procurement office would then award the purchase order. The MSDS process is complete. Our research indicates this scenario would occur in about 70 percent of procurement actions.



[a]Procurement office queries HMIS prior to purchase award.

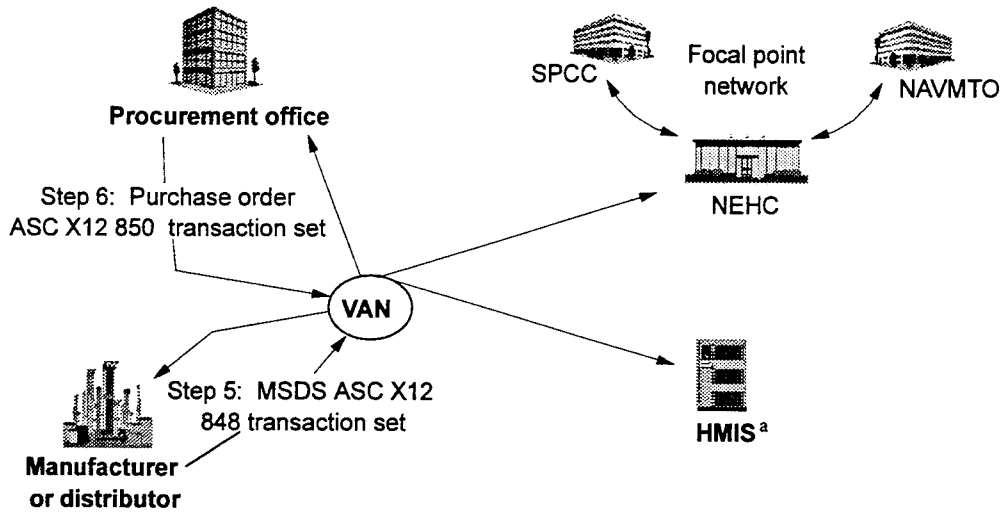
Figure 3-3.
Procurement Office Query of HMIS for HAZMAT Data

The DoD developed EDI implementation conventions for the common procurement actions shown in Figure 3-2. However, the ability to perform a direct HMIS query does not exist now and should not be accomplished as an EDI transaction. Depending upon future HMIS capabilities, the ability to perform an HMIS query might be served in the near term through the use of an electronic bulletin board containing MSDS header information necessary to positively identify a unique record. Eventually, HMIS on-line may provide access to the complete MSDS data set. Greater direct access to HMIS data for the general operational community, and procurement offices in particular, is essential for improving the MSDS process flow.

Phase 3

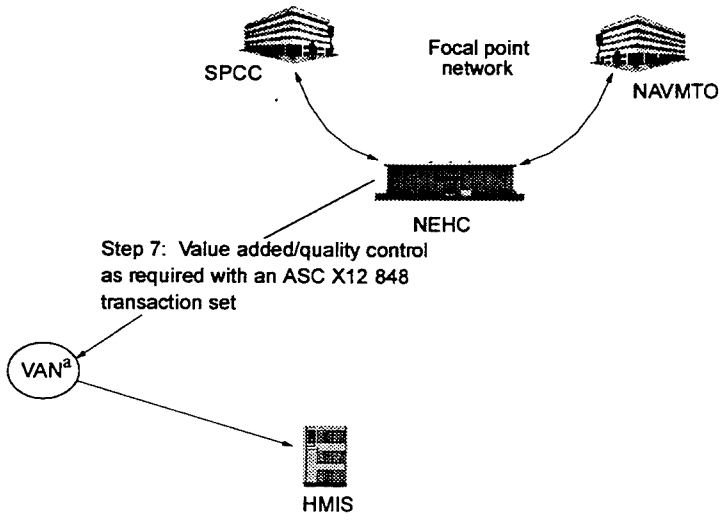
Assuming no MSDS record exists in HMIS, or that the current record has been superseded, the MSDS submission process continues as shown in Figure 3-4. In this case, using EDI, the supplier provides a copy of the manufacturer's MSDS for distribution to the procurement office, the focal point, and HMIS. The procurement office, if satisfied with the MSDS and other prerequisites, awards the contract. HMIS receives the MSDS and processes it for inclusion as a "skeleton" MSDS. The record itself should be "flagged" to reflect that it

represents an MSDS that has not yet been processed for value-added information or quality control. The focal point and subfocal points then provide the necessary information and quality control efforts required to complete the HMIS record as depicted in Figure 3-5 and described later in this section. These processes should not, however, delay users' access to the manufacturers' MSDSs.



[a]If no record exists, the supplier provides an MSDS as shown. The purchase order is then placed.

Figure 3-4.
MSDS Submission to HMIS and Focal Point Network



[a]The record exists within HMIS at this point. Value is added into the data base at NEHC through the focal point network and passed on to HMIS to supplement the MSDS record. The customer receives data on a timely basis.

Figure 3-5.
Value-Added Data to HMIS

The value-added HAZMAT data – typically disposal and transportation data – are generally useful to users at a later point in the HAZMAT's life cycle. In our proposed approach, those data supplement the basic MSDS information within HMIS but do not delay data availability to the user.

Phase 4

The focal point network, as described in Figure 3-5, consists of a data base [running on a personal computer (PC) file server] connected to subfocal points using the Navy's servers and logistic networks. This architecture allows for access to the MSDS records located at the focal point, by personnel at SPCC and NAVMTO for the addition of required data. The software receives the incoming electronic MSDS, preserves the data structure format, and exports the final MSDS record to HMIS either electronically over a network or, as in the current process, on a floppy disk. As shown in Figure 3-5, these data are added from several remote locations. Additionally, records may be appended or deleted entirely based upon quality control information resident at the focal point.

The overall Phase 4 approach focuses on reducing the volume of unnecessary data and increasing the speed with which basic data reach the user by minimizing the number of "roadblocks" between the supplier and the user. EDI facilitates the added benefit of automated processing, which reduces overall costs and further decreases the time it takes data to reach users. The ability to exchange data electronically, "application-to-application," constitutes one of EDI's greatest strengths. We address this point in greater detail later in this chapter.

Benefits of Proposed EDI-Based Process Flow

The benefits associated with any EDI project can generally be classified as either "direct" or "indirect."

Direct Benefits of Proposed Process Improvements — Cost Savings

Direct benefits include savings resulting from the elimination of tasks associated with paper processing. Depending upon the nature of the project, indirect benefits typically include reduced inventory levels, reduced lead-times, faster invoice processing, reduced late-payment charges, improved product quality, and streamlined operations. We feel that a reengineered MSDS process offers substantial potential for realizing both direct and indirect benefits, and we address each in the following sections.

We prepared a cost analysis comparing the cost of our proposed notional MSDS processing model to estimated current processing costs. Appendix A explains our cost analysis. The results suggest that a reengineered process can reduce current overall processing costs by more than 50 percent.

Three current MSDS processing areas provide the greatest opportunity for direct cost savings: the reduction of duplicate MSDSs, the elimination of administrative tasks, and the reduction of many tasks currently performed by the contractor. We believe the first two areas offer the Navy improved efficiency by a measure of approximately 50 percent over the current Navy-performed functions. In addition, we estimate that the Navy can reduce the cost of contractor services by nearly 60 percent.

Initially, increased use of electronic transfer will proceed slowly. However, actual savings at any given point will correspond directly to the level of implementation and the degree of trading partner participation. Still, clarifying policy with regard to MSDS submission can generate some of these savings almost immediately. For example, duplicate MSDSs received each year constitute roughly 17 percent of total processing costs. By eliminating duplicate records before they reach the focal point, we believe the Navy can immediately realize significant direct savings in Navy and contractor processing costs.

Table 3-1 summarizes the costs of the current process. The average cost to process a single MSDS is $40.[2] Direct Navy processing cost accounts for 33 percent of that total, and contractor services represent 67 percent. It is significant to note that duplicate MSDSs represent approximately 17 percent ($334,600) of the total program costs (each year).

Table 3-1.
Summary of Current MSDS Costs

Cost summary	Navy processing costs	Contractor costs	MSDS unit costs	Extended costs	Duplicate MSDSs
Current process (in dollars)	$13	$27	$40	$1,986,500	$334,600
As a percentage of total costs	33%	67%	100%	–	17%

Note: Dollar figures have been rounded to the nearest whole dollar.

Table 3-2 summarizes our estimate of a 50 percent cost reduction expected to occur through implementation of the proposed reengineered MSDS processing scheme. The contractor's service costs are held constant to illustrate direct savings to the Navy and the benefit associated with reduced duplicate MSDS processing. Direct savings can be attributed to the elimination of paper-based administrative tasks such as photocopying, sorting, and mailing – tasks made unnecessary in an electronic environment.

[2]The average cost is based upon a processing range of $10 per duplicate MSDS to $35 per original MSDS (excluding contractor costs), which processes through all subfocal points. See Appendix A for a detailed cost analysis.

Table 3-2.
Cost for Electronic-based MSDS Processing Scheme (Contract costs held constant)

Cost summary	Navy processing costs	Contractor costs	MSDS unit costs	Extended costs
Electronic processing (in dollars)	$6	$27	$33	$1,650,000
As a percentage of total costs	18%	82%	100%	100%

Note: Dollar figures have been rounded to the nearest whole dollar.

Our estimate addresses a topic requiring special note: data storage. DoD Instruction 6050.5 requires the Services to maintain each MSDS for 30 years. Storage of current records already poses a problem, and storage costs will increase. Maintaining an MSDS in an electronic format, however, is an economical solution requiring little investment.

Table 3-3 shows nearly a 50 percent cost avoidance realized through the reduction of the labor-intensive processes performed by contractor personnel. For example, trading partners exchanging MSDSs through a fully structured electronic format have little need to perform data entry. Translation software creates a user-defined file that is fully compatible with data base files. In our case, the contractor benefits from the elimination of administrative tasks in much the same manner as the Navy does, and it is in a better position to use limited resources to conduct MSDS analysis or quality reviews. Appendix A provides a detailed estimate of potential savings.

Table 3-3.
Cost for Electronic-based MSDS Processing Scheme (At full implementation)

Cost summary	Navy processing costs	Contractor costs	MSDS unit costs	Extended costs
Electronic processing (in dollars)	$6	$11	$17	$858,000
As a percentage of total costs	35%	65%	100%	100%

Note: Dollar figures have been rounded to the nearest whole dollar.

Indirect Benefits of Proposed Process Flow

While difficult to quantify and measure, indirect benefits typically provide the greatest value to an organization. Several industries estimate that indirect benefits and related savings exceed the direct benefits by a factor of two, or even three, to one. Generally, savings are realized through efficiencies such as

reduced inventory, reduced manufacturing costs, improved customer service, streamlined operations, and increased material visibility. We believe the reengineered process will provide the Navy with significant indirect savings opportunities through quicker, wider access to HAZMAT information.

Improved Personnel and Environmental Safety

Improved HAZMAT information availability will dramatically improve the Navy's ability to protect both personnel and the environment from injury or damage. Increased awareness of proper HAZMAT handling and disposal prevents accidents, the costs of which are immeasurable to the Navy and go far beyond a simple dollar value. While the current processing captures the MSDS data, those data may not reach the user community through normal channels for 8 months or more. This long delay is a window of vulnerability subjecting both the environment and Navy personnel to dangers. In conjunction with the immediate availability of more current HMIS data, electronic MSDS submissions can greatly narrow that window of vulnerability.

Lacking specific information regarding HAZMAT's true potential hazards, personnel must protect against the highest risk, resulting in inefficient HAZMAT handling and disposal. Increased awareness allows managers to properly gauge the intensity for managing material that may not present a risk to personnel or the environment. Material frequently remains idle in storage or pending disposal because the hazards have not been or cannot be identified. This lack of information impedes efficient HAZMAT handling and adversely impacts mission accomplishment. Evidence suggests that these scenarios are repeated regularly throughout the Navy as HAZMAT moves across organizations. Immediate access to accurate, unambiguous MSDS information will provide the information needed to prevent the frequency of such problems.

Improved Management Information

Increased visibility of management data allows the electronic MSDS to act as the "data engine" for other HAZMAT or material management programs. Pollution prevention managers can increase their visibility of net hazardous material or net waste for an individual facility. This benefit is contingent upon incorporation of HAZMAT data into material management functions, but an electronic MSDS will facilitate the necessary linkage. Similarly, improved management information availability can assist in identifying patterns of HAZMAT use, leading to increased HAZMAT visibility and improved material management practices. As a result, improved material cataloging, tailored authorized usage lists, reduced inventory levels, and a dramatic decline in the proliferation of HAZMAT will, in turn, lead to a reduction of accidents and disposal problems.

APPLICATION SOFTWARE

Automation at both the MSDS sending and receiving points characterizes EDI implementation. To this end, both the focal point and subfocal points must acquire and implement application software capable of receiving, storing, processing, and forwarding MSDSs and associated data for input into the HMIS.

Therefore, it is essential that the Navy address the issue of application software by carefully weighing the critical success factors. We recommend that the Navy evaluate and purchase an EDI-compatible commercial software package rather than develop a proprietary application package. Existing commercial software addresses organizations' employee safety requirements, provides a relational data storage capability, and provides a data retrieval system enabling suppliers to disseminate MSDSs. Additionally, existing software can easily be tailored to provide the flexibility to meet both focal point and subfocal point processing requirements.

A well-selected commercial package will allow the Navy to migrate to electronic MSDS processing quickly, with few unforeseen obstacles. Many software packages are available that emphasize flexibility and ease of operation across a variety of hardware platforms. Most software has capabilities beyond the simple storage of text files or data base records. This will allow the Navy to manage many or all data requirements in the HAZMAT spectrum.

We believe the cost of most software packages is extremely affordable when viewed in light of development and fielding costs associated with proprietary software. Continuing benefits are also derived through maintenance support resulting from changing reporting and data requirements experienced throughout the private sector. We believe that a robust software package meeting, and in most cases exceeding, the Navy's data and interface requirements can be purchased for less than $25,000.

The software selected should be flexible enough to satisfy current and future business requirements, current and future information requirements, and expected trading partner requirements. In the case of the latter, the Navy should consider off-the-shelf software requirements for interfacing with HMIS. (Currently, the application software will interface with HMIS via a Clipper data base application.) Disks would still be submitted to DGSC by mail. Future software enhancements or HMIS enhancements may provide the capability for direct interface, which is the preferred solution.

In addition to the technical and business considerations, the Navy should evaluate prospective suppliers with the idea of building a long-term relationship. Because of the unique requirements associated with DoD's MSDS processing, the Navy might require software customization, technical support, and unique networking capabilities. Available commercial software packages vary in their abilities to manage HAZMAT communications. Finding a reputable supplier with the technical abilities and background experience is critical.

STRATEGY FOR FUTURE SYSTEM DESIGN

The level of automation for MSDS processing is dependent upon the capabilities of the Navy's information nodes.

The Navy should consider two factors in the development of an MSDS processing implementation strategy. First, industry is still in the process of developing consensus on the format for exchanging MSDS data in an ASC X12 EDI structure. Initial efforts to define a consistent approach to MSDS structure in a paper, text-oriented format resulted in the development of the *Chemical Manufacturer's Association ANSI Z400.1 Draft Standard for Trial Use for the Preparation of Material Safety Data Sheets.* This effort has evolved into a move toward data codification and electronic exchange by industry groups such as CIDX (Chemical Industry Data Exchange), PIDX (Petroleum Industry Data Exchange), and Automotive Industry Action Group (AIAG).

Industry action groups (i.e., CIDX, PIDX, and AIAG) are developing and fielding guidelines for preparing the ASC X12 848 Material Safety Data Sheet transaction set in unstructured, semistructured, and fully structured data formats. The Navy should actively participate in this development process to ensure that all data requirements and reporting conventions are incorporated into the guidelines. Also, the Navy should aggressively support the development of a government-wide implementation convention specifically defining the data exchange requirements expected by all government organizations.

The unstructured and semistructured formats help standardize the MSDS content as well as the EDI transfer of data. However, they allow application software to act upon those data only to a very limited extent. Figure 3-6 illustrates that an MSDS transmitted using a semistructured data transfer convention remains essentially an organized text file requiring manual intervention to apply the data to any data base application. The data must be further parsed or organized using a word processing application before they become compatible with the HMIS format.

A fully structured industry data codification and electronic exchange guideline is expected to be written and accepted for PIDX and CIDX by the end of 1994. The fully structured format sufficiently codifies data so that they can be exchanged and stored in the codified format. Most of this capability will apply to data within the MSDS that are subject to codification (e.g., ingredients and properties). Large portions of the MSDS will remain in text format until industry can arrive at agreements on standard terms and phrases. EDI does not necessarily code the data content. Instead, the structured format simply identifies the type of data [e.g., CAGE, part number, Chemical Abstract Services (CAS) number, and flash point, etc.] so that application software can recognize and process it. This is illustrated in Figure 3-7. Although it is not the ultimate or most desired product, the fully structured format does allow the Navy to better utilize the opportunities made available by using EDI.

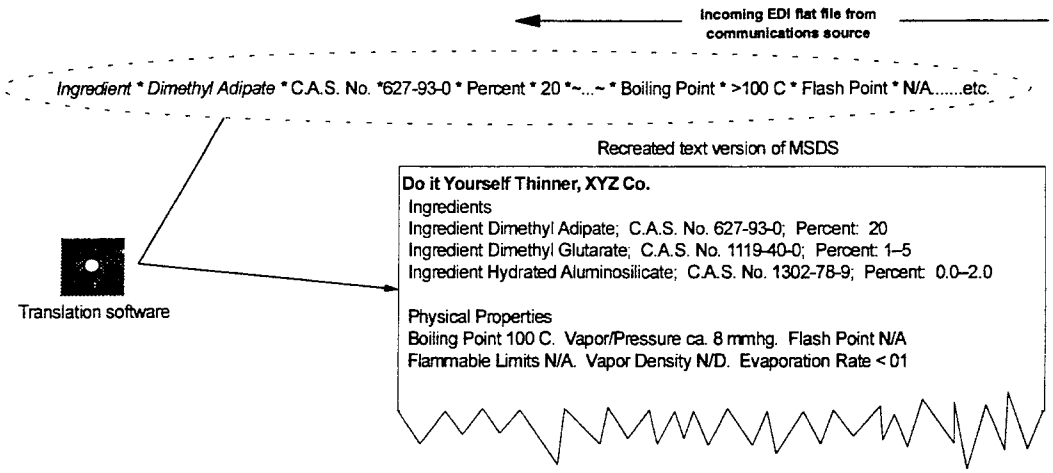
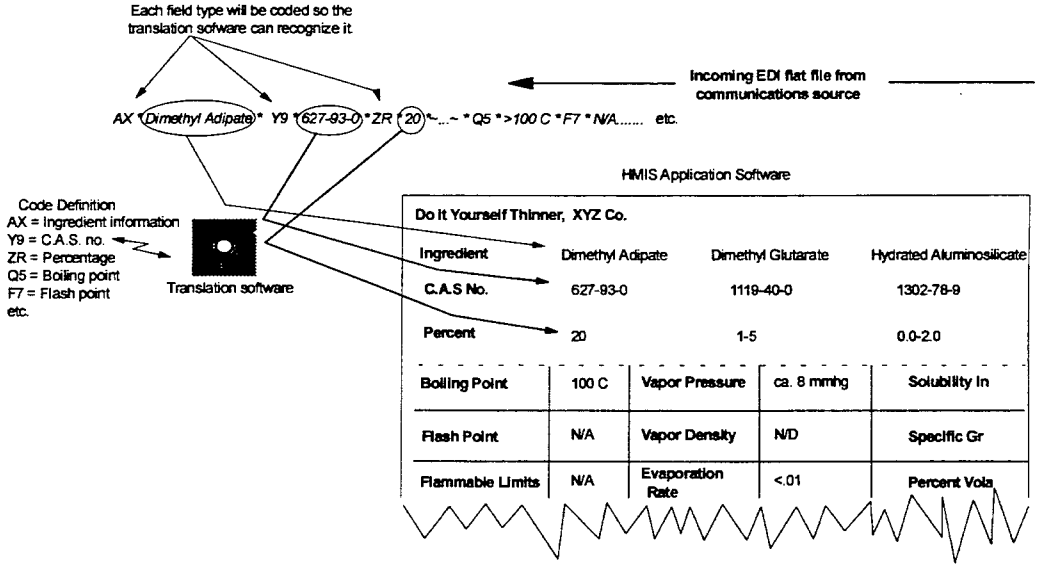


Figure 3-6.
MSDS Transmitted Using a Semistructured Data Transfer Convention



Note: The translation software can identify the data that follow from the code that is used. For example, "Y9" = CAS number; apply the content of that data to the appropriate place within the application software; for example, "627-93-0."

Figure 3-7.
Structured Translation

The Navy must carefully consider its course of action based upon its management information needs vis-a-vis the capabilities and timing of adequate support from HMIS. Any Navy actions should be carefully coordinated with other Services and agencies to avoid the proliferation of divergent processes and procedures.

As a second factor for consideration, the Navy must recognize that the majority of potential trading partners are not yet EDI-capable. While the majority of major industry corporations are EDI-capable, most of the smaller firms with whom the Navy trades do not possess much knowledge of, or capacity to conduct, EDI. Consequently, implementation and associated benefits initially may be modest, gradually accelerating as DoD trading partners increase their use of electronic commerce.

MIGRATION STRATEGY

Because industry guidelines are in a state of evolution and because initial EDI participation among trading partners may be limited, we recommend a migration strategy that will allow the Navy to take advantage of many of EDI's benefits immediately and invest in further system enhancements over the course of time. Figure 3-8 shows a migration strategy consistent with the proposed reengineered process.

The first step in implementing the reengineered process is to develop a focal point network linking a data base at the focal point with the other information nodes. The data base, in this case, serves several functions. First, the software employed will permit the electronic receipt of each MSDS. Second, the data base will preserve the format of the MSDS for on-line editing and quality control. Finally, the software will be capable of exporting the MSDS and all value-added data to HMIS either electronically or, as in the current process, via floppy disk.

Moving further along the implementation spectrum, the reengineered process will allow selected Navy field purchasing sites to verify the absence or preexistence of an MSDS in HMIS. This will require development of policy, changes in procedure, and more responsive access to HMIS data. However, it will start the process of eliminating duplicate submissions immediately and thereby reduce the volume received by the focal point activity. In cases where no record exists, the contracting officer should be capable of accepting the MSDS in either hardcopy or electronic form.

We recommend that the Navy aggressively seek out trading partners who are willing and able to exchange MSDSs using EDI – initially, in a semistructured format in order to accomplish this major step toward EDI implementation. Because of the learning curve associated with any EDI project, and because the structured format is still evolving within industry, the semistructured convention provides a good starting point at the early stage of project development. The Navy should also start to evaluate potential procurement sites based on MSDS volumes, existing EDI capabilities, and relationships with the selected commercial trading partners.

Further implementation requires increased participation among both Navy field purchasing sites and trading partners. We recommend developing a strategy that integrates the MSDS into the electronic exchange of contracting information for any HAZMAT purchase to provide an incentive for increased

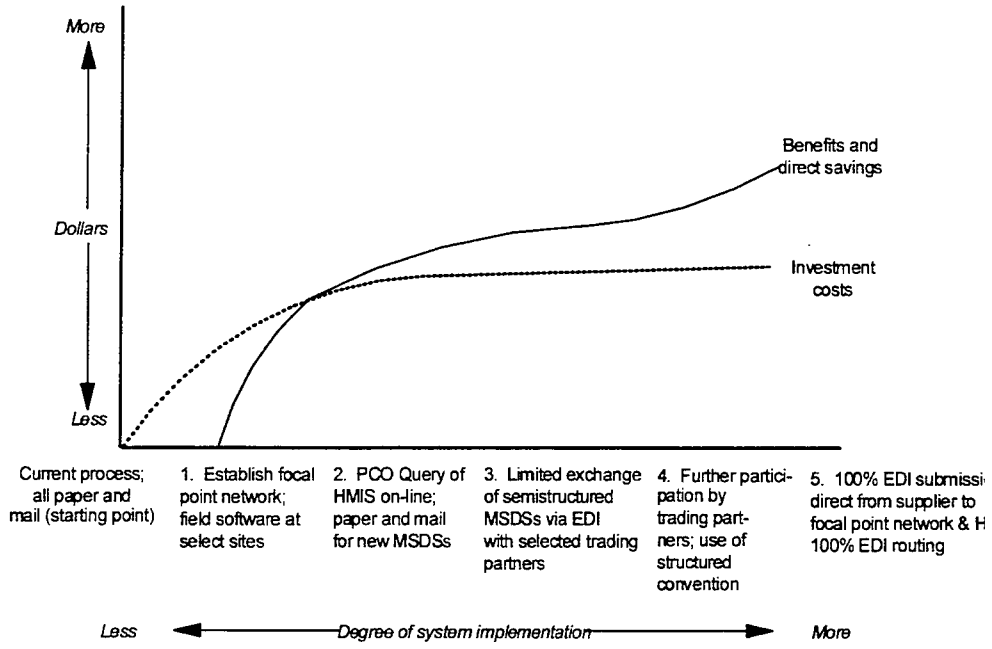


Figure 3-8.
System Migration Strategy

participation. We see additional opportunities for trading partners resulting from policy changes allowing for the use of manufacturers' MSDSs. By working with industry groups, we can expect to see the exchange of MSDSs in various formats with firms in the supplier, distribution, and resale channels that allow those entities greater ease in providing data when required.

Similarly, we can see the influence that DoD might exert in encouraging firms to obtain the services of service organizations that would convert suppliers' MSDS records into electronic data bases, or on an individual basis, would take a paper MSDS and format it in an ASC X12 format. This creates an additional, although minimal, one-time cost to the supplier, but it can help encourage greater participation among DoD trading partners. Participation, at this point, may become something of a self-driving force in conjunction with other electronic commerce initiatives.

After sufficient experience has been gained exchanging MSDSs in a semi-structured format, Navy should seek to maximize automation potential by using the structured MSDS formats. This will permit enhanced application-to-application processing and eliminate, or greatly reduce, the labor-intensive activities associated with current MSDS processing. In addition, the structured format allows for the integration of other HAZMAT applications that are dependent on these data for efficient management of HAZMAT.

Integral to the Navy's ability to execute this, or any other strategy, is the need to work closely with its private-sector trading partners. We strongly recommend that the Navy participate, individually or as part of DoD, in an aggressive initiative to work with industry action groups to create a spirit of mutual cooperation and joint development of the necessary data requirements associated with HAZMAT management. We believe that by allying with the appropriate industry segments, the Navy can effectively represent its needs to potential electronic trading partners and add momentum and credibility to the acceptance and use of the agreed upon conventions for MSDS data exchange.

Better Data Management

From an economic and management perspective, it makes little sense to maintain numerous MSDSs for the *same* hazardous item produced by several manufacturers when each provides the same information concerning hazards, safety, and handling. It is impractical for an employer to post multiple MSDSs in the working place or to scroll through multiple MSDSs on CD-ROM to determine the appropriate procedures for dealing with a HAZMAT emergency – especially if the manufacturer is not readily known. We recommend that the Navy establish the long-term goal of using a single MSDS for multiple products with similar compositions and hazards. Toward this goal, the Navy should augment the focal point's objectives to include assessing and authorizing use of the same safety and handling procedures for one hazardous item (as provided by an MSDS) as for similar hazardous items of similar composition and hazardous characteristics.

Additionally, to reduce the burden of managing large amounts of narrative textual data or MSDSs, the Navy should support and pursue the maximum possible codification of MSDS data, including the codification of textual data (e.g., precautions and treatments). Codification applies only to the electronic exchange of MSDS data and management in relational data bases. It does not apply to the conveyance of information to the ultimate user in readable textual formats. Industry trade groups and associations have developed a consensus position for a consistent MSDS format and structure. That position establishes significant progress toward the increased codification of MSDSs. The Navy should exploit that progress by establishing a close partnership with industry and championing the use of current data base management technology to accommodate the maximum use of codified data.

Strategic Planning

Increased awareness about the safe use, handling, and disposal of HAZMAT has resulted in a proliferation of Navy initiatives to address various aspects of HAZMAT management. Likewise, the Navy supports an aggressive program for EDI implementation initiatives. To realize the full value of these opportunities, we recommend that the Navy develop a HAZMAT strategic plan integrating

the management of HAZMAT and related information in an automated environment.

The strategic plan should identify and document opportunities for Navy HAZMAT initiatives to use EDI capabilities and to integrate the collection, management, and distribution of HAZMAT data. It should also identify opportunities to integrate ongoing HAZMAT business requirements within existing Navy material management business processes. The plan should reflect full collaboration with DoD, DoD Services and agencies, and industry (including the application of innovative industry efforts as they relate to HAZMAT management).

SUMMARY

A complete shift in HAZMAT management processes achieved by applying EDI technologies can dramatically improve existing practices. Automation, streamlined processes, and an integrated management strategy afford the Navy the opportunity to

- expedite the availability of accurate and useful information to the user,
- reduce operating costs,
- use MSDS data in a variety of management initiatives, and
- control the proliferation and use of HAZMAT.

APPENDIX A

Cost Calculations

BASELINE COSTS

This appendix presents the worksheets used to calculate the cost projections listed in Tables 3-1, 3-2, and 3-3 of this report. These tables estimate the impact of implementing our notional reengineered business process. Although neither absolute nor precise, they do reflect order-of-magnitude projections.

All costs associated with material safety data sheet (MSDS) processing represent either (1) time and effort invested at each subfocal point or (2) outside processing (contracted services). While we distinguish between estimated costs in the first case and fixed, known costs in the second, all costs represent only the labor content of processing each MSDS. More time invested will result in higher unit costs at each subfocal point. Our cost model identifies those specific areas where the application of increased labor resources will not equitably increase the value of the end product and its utility to the end user.

Background for Calculations

To establish a baseline cost model, we estimated the time required to perform each function listed in Table A-1 at each of the appropriate subfocal points. All tasks in the process have been aggregated into one of the five cost activities listed. For example, the cost of document handling includes administrative activities such as filing, photocopying, routing, logging, and retrieval. The cost displayed is an estimate of time required to perform each task multiplied by an appropriate government service rate. Additional costs that are not time-dependent, such as mailing costs, have been factored into the cost estimates and are explained in the notes accompanying Table A-1. In the case of quality control and research costs at the Navy Environmental Health Center (NEHC), we used the estimated average processing cost supplied to us, which is based upon NEHC's estimates.

To account for the varying degrees of processing, we divide Table A-1 into those actions that occur prior to screening each record as an original or duplicate record and those actions that take place after duplicate detection. Because duplicate detection occurs while the records are in the custody of NEHC, MSDSs received by NEHC are factored at 100 percent while outgoing MSDSs represent approximately 30 percent of MSDSs received. In addition, because only Navy-managed stock-numbered items currently process through both SPCC and NAVMTO, we used a 5 percent screening factor to adjust for the estimated volume of MSDSs flowing through these subfocal points.

As indicated in Table A-1, we estimate MSDS processings costs as an average on the basis of a range of processing, at $13.24 per record. Table A-1 also reflects the upper range of processing for Navy-managed items, at $35.32. These records process through all subfocal points; we refer to this estimate as the Total gross cost. The following subsections detail the costs at each information node.

Table A-1.
Current MSDS Processing Costs

Cost activity	Before MSDS screening factor applied		After MSDS screening factor applied			Total cost ($)
	Procurement office ($)	NEHC ($)	NEHC ($)	SPCC ($)	NAVMTO ($)	
Document handling	$3.60	$3.60	$0.90	$1.30	$0.90	$10.30
Document processing	1.80	—	0.90	1.30	0.90	4.90
Quality control/research	—	—	6.78	7.82	2.70	17.30
Communications[a]	0.47	—	0.86	1.07	0.02	2.42
Storage	0.10	—	0.10	0.10	0.10	0.40
Total gross cost	$5.97	$3.60	$9.54	$11.59	$4.62	$35.32
Screening factors[b]	100%	100%	30%	5%	5%	—
Cost after screening for duplicates/local stock numbers (net)	$5.97	$3.60	$2.86	$0.58	$0.23	$13.24

Note: Figures rounded to the nearest whole penny.

[a] Communications costs consist of estimates of time invested to contact suppliers as well as associated mailing costs.

[b] MSDS volume flow returning to NEHC from the contractor is estimated at 30 percent of all submissions. Navy-managed items are estimated at 5 percent of all submissions. The appropriate fraction was used to calculate the net average cost after screening for each activity and to calculate program costs as a whole.

Procurement Office

The costs defined by the procurement office in Table A-1 are similar in most procurement offices. Specific processes will differ among the many activities currently submitting MSDSs, but our research suggests that the typical procurement office engages in all of those activities listed except for quality control and research. Policy requires the buyer to ensure data completeness for each MSDS received. While this is a form of quality control, the level of effort actually expended requires a negligible cost. Other tasks, which individually do not appear to represent a significant investment in time, such as those addressed under document handling, take on increased significance when viewed in light of the volume of MSDSs processed.

Of some importance is the fact that all procurement office activities take place even if the HMIS has a previous, identical record on file. The costs associated with processing any record, including duplicates, are represented by those activities listed under the heading "Before MSDS screening factor applied" in Table A-1. Because duplicate records are shredded upon their eventual identification, any effort dedicated to their processing is transparent to the end user and thus represents nonvalue-added costs.

Navy Environmental Health Center

The focal point for MSDS processing serves as the information hub and the central processing point. Time invested at the NEHC includes labor-intensive activities such as data entry, quality control, and research. Other ancillary costs, such as receiving, logging-in, photocopying, etc., do not appear to contribute significantly to overall cost until viewed in the context of the annual volume. These administrative costs also occur before detection of duplicates and represent nonvalue-added costs in approximately 70 percent of the cases. These tasks are reflected as document handling costs under the heading "Before MSDS screening factor applied" in Table A-1.

Because the contractor screens MSDS records for duplicates, the volume returning to NEHC is approximately 30 percent of the original number received. To account for this in our model, we deducted 70 percent from the estimated processing cost for original submissions. Indirect processing costs (contractor services) will be discussed later in this appendix.

Environmental Control and Packaging Division (Ships Parts Control Center)

The purpose for SPCC involvement in MSDS processing is to obtain and assign the hazardous characteristic code (HCC) and special material characteristic code (SMCC) for each hazardous item. Research and communication with suppliers and manufacturers account for the majority of the cost. In an effort to obtain HCC and SMCC, personnel must invest a significant amount of time in research and communication with the supplier. This information equates to a significant processing cost. Because only 5 percent of the records actually reach SPCC, however, these costs do not significantly contribute to the program's overall cost.

Navy Material Transportation Office

A recent policy decision to process MSDSs only for centrally managed items with national stock numbers has dramatically reduced the NAVMTO MSDS processing requirement. Again, our research indicates that no more than

5 percent of all submissions currently process through this subfocal point for the addition of transportation data.

The research invested in an MSDS at this point is not exhaustive, consisting primarily of a reference to other published documents. Rarely does research require contacting the supplier or manufacturer directly. Consequently, we consider the NAVMTO processing impact insignificant in terms of cost.

Aggregate Costs and Summary

The total direct processing costs to the Navy are associated with the processes described in the subsections above. The aggregate (total) unit cost of each MSDS must include those processes currently performed by a government contractor. Contractor services primarily consist of data entry, limited research, and quality control. For a fixed-dollar contract and annual volume estimated at 50,000 total (gross) MSDS submissions, we calculate a cost of $26.50 per MSDS processed. We then calculate the aggregate cost as shown in Table A-2.

Table A-2.
Summary of Current Costs

Average unit cost (from Table A-1)	$13.24
50,000 submitted (gross)	50,000
Navy processing (direct)	$661,500
Contract FY94	$1,325,000
Total MSDS processing cost	$1,986,500

Reengineered Processing Costs

On the basis of our proposed notional architecture for the MSDS data flow described in Chapter 3, we can identify the processes fundamentally altered from the current process and any associated cost differences. Any reduction in these activities reduces costs at no expense to the quality of the product. In short, we believe that the cost savings opportunity in eliminating nonvalue-added efforts exceeds 50 percent of the total current processing costs.

By way of comparison, Table A-3 illustrates estimated reengineered processing costs in a format comparable to Table A-1. In the electronic environment, virtually all administrative tasks become unnecessary.

In the reengineered process, procurement contracting officers (PCOs) identify duplicate records during the normal course of the HAZMAT purchase. The

effort invested in identifying the duplicate MSDSs consists of those actions listed below the "Before MSDS screening factor applied" heading. In this case, redundant efforts are limited to those actions performed at the procurement office. This represents a substantial reduction in effort and would account for the majority of the Navy's direct savings.

Table A-3.
Estimated Processing Costs in the Proposed Electronic Environment

Cost activity	Before MSDS screening factor applied	After MSDS screening factor applied			Total cost ($)
	Procurement office ($)	NEHC ($)	SPCC ($)	NAVMTO ($)	
Document handling	—	—	—	—	$0.00
Document processing	2.70	0.90	1.30	0.90	5.80
Quality control/research	—	6.78	7.82	2.70	17.30
Communications	0.18	0.54	0.78	0.02	1.52
Storage	—	0.07	—	—	0.07
Total gross cost	$2.88	$8.29	$9.91	$3.62	$24.69
Screening factor	*100%*	*30%*	*5%*	*5%*	—
Cost after screening for duplicates/local stock numbers (net)	$2.88	$2.49	$0.50	$0.18	$6.05

Note: Figures rounded to the nearest whole penny.

Based on the electronic receipt and processing of MSDS records, we project a 60 percent reduction in costs at NEHC. Because the requirement for limited data entry will likely continue, we included these costs in the estimate as part of the document processing costs. We also assume that a continuing level of quality control and research will remain. Although it is likely that the electronic structure will enhance the focal point's ability to perform quality control and research, we believe that any cost savings estimate in this area is too subjective to include as part of the model.

In addition to eliminating administrative redundancies, electronic processing also offers the cheapest storage solution. Because DoD policy requires the focal point to maintain each MSDS for 30 years, storage is a significant cost to the Navy now and in the future. Electronic media storage presents the most viable solution because electronic records require negligible space and effort to maintain.

CONTRACTOR COST ANALYSIS

Table A-4 estimates the level of effort required by the contractor for each operating scenario. These are estimates for demonstration purposes only; they are always subject to negotiation among the Navy sponsor, PCO, and contractor. We identify tasks reduced or eliminated by electronic processing and remove the associated costs from the value of the contract. The comparison of the cost structure estimates illustrates the efficiency gained through use of technology in otherwise labor-intensive functions. This comparison assumes full EDI implementation and participation by the Navy's trading partners. For the near future, we believe savings will be more modest, corresponding directly to the level of implementation and trading partner participation achieved.

In this example, we estimate the breakdown of contractor costs by each cost activity performed in support of the contract. Initially, we eliminated estimated contractor fee and general and administrative (G&A) costs to estimate the G&A base. We then eliminated from the G&A base the estimated overhead, assumed to be 100 percent of direct labor cost. For this analysis, we also assumed overhead to be completely variable with total labor. In reality, actual overhead would consist of fixed or semi-fixed costs, such as the building lease and utilities, in addition to those costs generally considered variable. We assumed labor to be a variable cost.

By breaking down the cost of services provided into each activity, we can then isolate the costs that can be reduced or eliminated by using EDI and the reengineered process. In the new process, for example, the requirement to screen MSDSs by changes, or duplicates is eliminated. Labor-intensive processes, such as data entry, and administrative processes benefit most from EDI. Recognizing that these requirements would probably not be eliminated completely because of required editing, we estimated a reduction of 80 percent. We assume no change in screening part numbers or in the level of effort dedicated to quality control.

We can then estimate the direct costs as the sum of labor for each activity. By adding overhead, G&A costs, and contractor fees, we can estimate the value of services provided, after fully implementing EDI, as shown in Table A-4. While the numbers used in Table A-3 are not intended to represent the contractor's actual cost structure, we believe significant cost reductions, potentially exceeding 50 percent, are possible.

Further, by including the estimated savings realized directly by the Navy, we can prepare a similar table to estimate total savings. Table A-5 summarizes the total savings estimates.

Table A-4.
Estimate of Contractor Costs and Potential Reductions

Current process			
FY94 contract value			$1,325,000
Deduct fee:	@ 10% of total costs		(120,545)
Total costs			1,204,455
Deduct G&A:	@ 13% of G&A base		(138,576)
G&A base			1,065,879
Overhead	@ 100% labor		532,940
Direct costs			
	Sorting adds/duplicates	53,294	
	Screening part numbers	79,941	
	Data entry	239,823	
	Quality control	79,941	
	Administrative functions	79,941	
			532,940
Reengineered process			
G&A base			
Direct costs			
	Sorting adds/duplicates[a]	n/a	
	Screening part numbers	79,941	
	Data entry[b]	48,000	
	Quality control	79,941	
	Administrative functions[c]	16,000	223,882
Add overhead:	@ 100% labor		223,882
			447,764
Add G&A:	@ 13% of G&A base		58,209
			505,973
Add fee:	@ 10% of costs		50,590
Estimated value			$556,605

[a] In the notional concept, procurement activities screen MSDSs before submission to the focal point. This task would therefore not be required by the contractor.

[b] These requirements were assumed to be reduced by approximately 80 percent at full EDI implementation.

[c] Rounded to nearest thousand.

Table A-5.
Reengineered Processing Costs, Including Percentage Reduction After Fully Implementing EDI

Average unit cost (from Table A-3)	$6.05	54%
50,000 submitted (gross)	50,000	–
Navy processing (direct)	$302,000	54%
Contract FY94	$556,000	58%
Total MSDS processing cost	$858,000	57%

APPENDIX B

Electronic Data Interchange

Electronic data interchange (EDI) is the computer-to-computer exchange of routine business documents between trading partners using a public standard format. Private firms and, to a limited extent, government organizations, are using EDI to exchange purchase orders, shipping notices, receipts, invoices, payments, and a variety of other business documents. Rather than preparing paper and sending it through the mail, or using other communications methods such as telex, EDI users exchange business data directly between their respective computer systems. It is not limited by differences in computer or communications equipment. Rather, EDI bridges the information gap between organizations with different computer systems. In doing so, EDI users reap a number of benefits, including reduced data entry errors, decreased paper handling, reduced inventories, improved cash management, shortened order times, and improvements in overall operating efficiency.

DEFINITION

Electronic data interchange is defined as

> The exchange of routine business transactions in a computer processable format, covering such traditional applications as inquiries, planning, purchasing, acknowledgments,... test results, shipping and receiving, invoices, payments, and financial reporting.[7]

We can characterize EDI as follows:

- It is a set of automated business transactions flowing between organizations.
- It relies on supporting business application software but is not itself a computer system.
- It is the process by which transactions are linked to the application software to improve business processes.
- It is a philosophy for conducting business. It integrates business functions, is the basis for process improvement, and extends the traditional bounds of the enterprise in the marketplace.

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[7] Data Interchange Standards Association Inc., *An Introduction to Electronic Data Interchange*, September 1991.

Several years ago, the Garter Group, a consulting firm, identified the following attributes of commercial business processing:

- Of all computer information entry, 75 percent comes from another computer.
- For each product shipment, 14 information exchanges occur.
- Creating and exchanging one business page costs $50 manually and $4 electronically.

Generally, EDI benefits fall into two categories: direct and indirect. Direct benefits are those associated with eliminating paper handling and include

- reduction in data entry costs,
- reduction in researching and correcting data entry errors,
- elimination of the delays and costs associated with mailing paper forms, and
- elimination of paper reproduction and storage costs.

Indirect benefits accrue from changed business practices (usually associated with automating and streamlining previous manual processing). They are typically harder to identify and quantify. In many EDI applications, however, they represent significantly larger opportunities than the direct savings. The following are typical indirect benefits in material management:

- reduction in inventory size and handling,
- reduction in transportation costs,
- reduction in production lead times, and
- reduction in procurement costs and delays.

A National Standard for EDI

In the mid-1970s, the commercial transportation industry began to use electronic transmission and automation concepts to track railway cars and containers. In 1978, the American National Standards Institute established the Accredited Standards Committee (ASC) X12 to define national standards for EDI. From those beginnings, EDI has grown steadily into all areas of American and international commerce.

EDI IN THE DEPARTMENT OF DEFENSE

In many ways the Military Standard Requisitioning and Issue Procedures, initiated in 1962, is the earliest implementation of EDI. Computers at Service activities around the world maintain asset balances for their sites. When consumption reduces inventory to a preestablished reorder point, the computer generates a standard-format electronic requisition to an inventory control point (ICP). The ICP computer determines the depot appropriate to receive delivery of the material and issues an electronic material release order. All these actions are performed with minimal human intervention. For some 20 years after 1962, DoD extended its electronic operations to most supply operations but failed to carry it into many other business functions.

COMPONENTS OF EDI

Electronic data interchange is not technically complex. It is based on the use of message standards, which ensures that all participants use a common computer language. A message standard consists of uniform formats for business, security, and control documents; security and control elements; and other rules and conventions relating to the use of transaction sets. To conduct EDI the following components are necessary (see Figure B-1):

- application software to generate the data to be transmitted electronically and application software to receive and to process the data,
- an ASC X12 transaction set to carry the data and implementation conventions to define trading partner usage,
- translation software to convert the data between the application software formats and the ASC X12 EDI formats, and
- a telecommunications network to transmit the EDI data.

Transaction Set

The ASC X12 standards contain the transaction set 848 Material Safety Data Sheet. That transaction set can support MSDS data; in fact, it is currently used commercially.

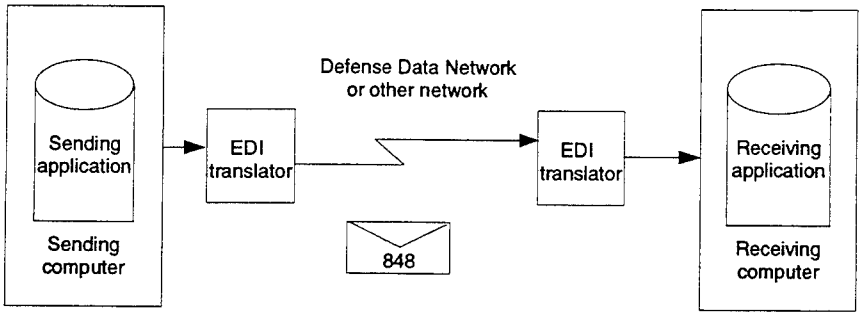

Figure B-1.
Components for Conducting EDI Transactions

Translation Software

Translation software converts data between the ASC X12 transmission formats and the internal formats used by the application software system(s). It also maintains a historical record for auditing purposes and sends/receives information through telecommunications networks. Each participating partner must have access to an EDI translator.

Translation software can reside either on the same hardware as the application system, on a separate computer at the site, or be linked by communications to a regional site. Translation software and hardware are widely available from commercial vendors for a variety of computers. The Navy currently uses American Business Computer's EDI-Excel translation software on IBM-compatible personal computers and IBM RS/6000 platforms. The basic architecture will support any ASC X12-compliant translator.

Telecommunications

Telecommunications systems link activities exchanging EDI transactions. The Navy uses government and commercial telecommunications media [e.g., value-added networks (VANs), and private networks] that link Navy translators with trading partners' systems. Existing capabilities include the Navy logistics network, Defense Data Network, direct-dial asynchronous telephone lines, bi-synchronous connections, and several VANs.

NAVY ARCHITECTURE

The components of EDI form the current overall architecture of the Navy's concept of operation, a regional support scheme of shared translators located at

translation sites. Each translation site supports multiple interface programs and end-user systems at application sites. Sites are connected to one ore more VANs that serve one or more trading partners. Such an architecture emphasizes a concept of shared resources, supports minimal trading partner connectivity requirements, and is compatible with current commercial computer practices.

APPENDIX C

Glossary

AIAG	=	Automotive Industry Action Group
ANSI	=	American National Standards Institute
ASC	=	Accredited Standards Committee
AUL	=	authorized use list
BUMED	=	Bureau of Medicine and Surgery
CAGE	=	Commercial and Government Entity
CAS	=	Chemical Abstract Services
CD-ROM	=	compact disc read-only memory
CFR	=	Code of Federal Regulations
CIDX	=	Chemical Industry Data Exchange
DDN	=	Defense Data Network
DGSC	=	Defense General Supply Center
DLA	=	Defense Logistics Agency
DoDI	=	Department of Defense Instruction
EDI	=	electronic data interchange
FAR	=	Federal Acquisition Regulation
G&A	=	general and administrative
GS	=	Government Service
HAZMAT	=	hazardous material

HCC	=	hazardous characteristic code
HICS	=	Hazardous Inventory Control System
HMIS	=	Hazardous Material Information System
ICP	=	inventory control point
IG	=	Inspector General
LAN	=	local area network
MILSTRIP	=	Military Standard Requisitioning and Issue Procedures
MSDS	=	material safety data sheet
NAVMTO	=	Navy Material Transportation Office
NAVSUPSYSCOM	=	Naval Supply Systems Command
NEHC	=	Navy Environmental Health Center
NLN	=	Navy logistics network
NSN	=	national stock number
OPNAVINST	=	Chief of Naval Operations Instruction
OSHA	=	Occupational Safety and Health Administration
P2	=	Navy Pollution Prevention Program
PC	=	personal computer
PCO	=	procurement contracting officers
PIDX	=	Petroleum Industry Data Exchange
SHML	=	ships hazardous material list
SMCC	=	special material characteristic code
SPCC	=	Ships Parts Control Center
VAN	=	value-added network